Disposition of Recommended Modifications of JSC 30426

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Introduction:

On May 11, 1988 changes and additions to the Space Station External Contamination Control Document JSC 30426 were addressed at length as part of the charter of this workshop. The modifications and disposition thereof are given below in a concise form in order that a clear understanding of the recommendations and current status be presented. The format is that each paragraph under question is given along with the proposed modified paragraph followed by the workshop's disposition. In some cases, a brief explanation of the issue is given prior to the paragraph in question.

Disposition of Recommended Changes to JSC 30426

Paragraph 3.1.1

A two-week quiescent period may be overly restrictive on Space Station resulting in cost impacts on the Space Station design to allow storage of all wastes for that period.

Old: Generally, environment conditions as stated in paragraph 4.5.1 shall be maintained for up to 14 days during required viewing periods.

Suggested New: Quiescent period as stated in paragraph 4.5.1 shall be maintained for 70% of each consecutive orbit during required data take periods for up to 3 days duration.

Disposition: Recommend further study.

Paragraph 4.5.1.1

Insert word "continuum" before each "background" and sentence "Line and band emitting species will have column densities satisfying 4.5.1.2.1".

Old: The total Ultraviolet (UV) and visible radiation background from spacecraft-induced particulate and molecular scattering and emission must be less than the envelope defined by the spectral irradiances in Table 4-1. For the Infrared (IR), the background intensity must be spatially and temporally uniform with a maximum variation of 1.1×10^{-13} watts m^{-2} sr^{-1} nm^{-1} per degree and 5.5×10^{-14} watt m^{-2} sr^{-1} nm^{-1} per second from 5 micrometers to 30 micrometers and 1.1×10^{-12} watt m^{-2} sr^{-1} nm^{-1} per degree and 5.5×10^{-13} watts m^{-2} sr^{-1} nm^{-1} per second above 30 micrometers. To achieve this, the background spectral

irradiance must be held below the envelope shown in Table 4-2. The maximum allowed value applies only if the background is temporally and spatially uniform enough to meet the stated requirements. The recommended values are based on a best estimate of the anticipated spatial variations.

Suggested New: The total Ultraviolet (UV) and visible radiation continuum background from spacecraft-induced particulate and molecular scattering and emission must be less than the envelope defined by the spectral irradiances in Table 4-1. For the Infrared (IR), the continuum background intensity must be spatially and temporally uniform with a maximum variation of 1.1×10^{-13} watts m^{-2} sr^{-1} nm^{-1} per degree and 5.5×10^{-14} watt m^{-2} sr^{-1} nm^{-1} per degree and 5.5×10^{-13} watts m^{-2} sr^{-1} nm^{-1} per second above 30 micrometers. To achieve this, the continuum background spectral irradiance must be held below the envelope shown in Table 4-2. The maximum allowed value applies only if the continuum background is temporally and spatially uniform enough to meet the stated requirements. The recommended values are based on a best estimate of the anticipated spatial variations. Line and band emitting species will have column densities satisfying 4.5.1.2.1.

Disposition: Recommend implementation.

Paragraph 4.5.1.2.2

The allowable limits in this paragraph should be adjusted to be compatible with Table 4-1.

Old: 1×10^{13} molecules/cm^2 each for O2 for N2, for H2, for noble gases and for all other UV and non-IR active molecules combined (total not to exceed 5×10^{13} molecules/cm^2).

Suggested New: 2×10^{11} molecules/cm^2 each for O2 and N2, for H2, for noble gases and for all other UV and non-IR active molecules combined (total not to exceed 1×10^{12} molecules/cm^2) for any line of sight that is not grazing-incident on a Space Station surface (i.e., main cluster, truss structure, and/or solar panel arrays).

Disposition: Recommend implementation.

Paragraph 4.5.1.3.1

Old: Release of particles from main cluster Space Station shall be limited to one particle 5 microns or larger per orbit per 1×10^{-5} steradian field of view as seen by a 1 meter diameter aperture telescope.

Control of particles less than 5 microns in size shall meet TBD requirements.

Suggested
New: The total ultraviolet, visible and infrared background from spacecraft induced particulates must be less than the background defined by the spectral brightness in Tables 4-1 and 4-2.

Disposition: Recommend implementation.

Paragraph 4.5.1.3.2

Old: TBD

Suggested
New: 4.5.1.3.2A - The particle deposition on surfaces with an acceptance angle of 2π sr shall not exceed 0.5 percent obscuration. 4.5.1.3.2B - The change in BDRF due to particle deposition on surfaces with an acceptance angle of 0.1 sr shall not exceed 50 percent (clean versus contaminated).

Disposition: Recommend clarification and further study.

Paragraph 4.5.1.4

The deposition rates on surfaces may be overly restrictive for surfaces such as thermal control, solar arrays, radiators, habitation modules, etc.

Old: The flux of molecules emanating from the core Space Station must be limited such that:

4.5.1.4.A. The mass deposition rate on two 300 °K surfaces both located at the PMP with one perpendicular to the +Z axis and the other whose surface normal lies in the horizontal plane and at critical power locations with an acceptance angle of 2π steradian shall be no more than 1×10^{-14} g/cm^2 sec (daily average).

4.5.1.4.B. The mass deposition rate on a 300 °K surface located at the PMP and perpendicular to the Z axis with an acceptance angle of 0.1 steradian shall be no more than 1×10^{-16} g/cm^2 sec (daily average).

4.5.1.4.C. The mass deposition rate on a 5 °K surface located at the PMP and perpendicular to the Z axis with an acceptance angle of 0.1 steradian shall be no more than 2×10^{-13} g/cm^2 sec (daily average) excluding condensation of atmospheric constituents.

Suggested
New: 4.5.1.4.A. The mass deposition rate on two critical optical 300 °K surfaces both located at the PMP with one perpendicular to the +Z axis and the other whose surface normal lies in the horizontal plane and at critical power locations with an acceptance angle of 2π steradian, shall be no more than 1×10^{-14} g/cm^2 sec (daily average).

4.5.1.4.B. The mass deposition rate on a critical optical 300 °K surface located at the PMP and perpendicular to the Z axis with an acceptance angle of 0.1 steradian shall be no more than 1×10^{-16} g/cm^2 sec (daily average).

4.5.1.4.C. The mass deposition rate on a 5 °K surface located at the PMP and perpendicular to the Z axis with an acceptance angle of 0.1 steradian shall be no more than 2×10^{-13} g/cm^2 sec (daily average) excluding condensation of atmospheric constituents.

Disposition: Recommend further study.

Paragraph 4.5.1.5

Efforts to anticipate under what conditions arcing and discharges will occur for high-voltage Space Station subsystems indicate potential problems (see following paper by N. Singh). Therefore, the addition of a paragraph 4.5.1.5, labeled Induced Neutral Density is recommended.

Old: N/A

Suggested New: The maximum density of induced neutral species in the vicinity (1 meter) of operating solar arrays shall be less than 10^{10} cm^{-3}.

Disposition: Recommend incorporation.

Paragraph 4.5.2.1

Old: Total deposition on sensitive surfaces such as solar arrays on either the astronomy or Earth resources observation regions shall not exceed 4×10^{-7} g/cm^2 yr.

Suggested New: Total deposition on sensitive surfaces such as the astronomy or Earth resource observation regions shall not exceed 4×10^{-7} g/cm^2 yr. Total deposition on solar arrays shall not exceed 5×10^{-5} gm cm^{-2} over the lifetime of the arrays. Total deposition on external thermal control surfaces shall not exceed 2×10^{-5} gm cm^{-2} over the lifetime of the surfaces.

Disposition: Recommend further study.

Paragraph 4.5.2.2

Old: TBD

Suggested
New: Requirements in 4.5.1.3.2 shall apply during both quiescent and non-quiescent periods.

Disposition: Recommend further study pending clarification of paragraph 4.5.1.3.2.

Paragraph 4.5.2.3

For the same reasons given in Paragraph 4.5.1.5 the following paragraph 4.5.2.3 labeled Induced Neutral Density is recommended as follows.

Old: N/A

Suggested
New: Requirements in Paragraph 4.5.1.5 shall apply during both quiescent and non-quiescent periods.

Disposition: Recommend further study.

Table 4-2.

Old:

TABLE 4-2. INFRARED BACKGROUND SPECTRAL IRRADIANCE

WAVELENGTH (Micrometers)	RECOMMENDED SPECIAL IRRADIANCE (watts m^{-2} sr^{-1} nm^{-1})	MAXIMUM SPECTRAL IRRADIANCE (UNIFORM BACKGROUND) (watt m^{-2} sr^{-1} nm^{-1})
1	1.0×10^{-10}	1.0×10^{-10}
5	5.0×10^{-11}	1.0×10^{-10}
10	4.0×10^{-11}	2.0×10^{-10}
<30	1.0×10^{-11}	4.0×10^{-11}
>30	6.0×10^{-12}	3.0×10^{-11}
300	3.0×10^{-13}	1.0×10^{-11}

Suggested
New:

TABLE 4-2. INFRARED CONTINUUM BACKGROUND SPECTRAL IRRADIANCE

WAVELENGTH	RECOMMENDED SPECIAL IRRADIANCE	MAXIMUM SPECTRAL IRRADIANCE (UNIFORM BACKGROUND)
(Micrometers)	(watts m^{-2} sr^{-1} nm^{-1})	(watt m^{-2} sr^{-1} nm^{-1})
1 - 3	1.0×10^{-10}	1.0×10^{-10}
3 - 7	5.0×10^{-11}	1.0×10^{-10}
7 - 15	4.0×10^{-11}	2.0×10^{-10}
15 - 30	1.0×10^{-11}	4.0×10^{-11}
30 - 200	6.0×10^{-12}	3.0×10^{-11}
200 - 500	3.0×10^{-13}	1.0×10^{-11}

Disposition: Recommend implementation.